About the SD188ES/SD188EM Demonstration Board

The AMD® SD188ES/SD188EM Demonstration Board is designed as an exceptionally small, low-cost product for demonstration of the AMD Am188™ES and Am188™EM microcontrollers. See page ix for a block diagram of the board.

The SD188ES/SD188EM demonstration board is a stand-alone evaluation platform for the Am188ES or Am188EM microcontroller. The Am188ES and Am188EM microcontrollers integrate peripherals such as 12 chip-select controllers, serial controllers, 32 programmable I/Os, three timers, an interrupt controller, and watchdog timer to increase system functionality while reducing overall cost. The memory controller supports a glueless connection to SRAM, EPROM, Flash memory, and pseudo-static RAM. The Am188ES and Am188EM microcontrollers also feature an innovative bus design that frees the processor to run at nearly twice the speed of standard 80C188 processors while using commodity memory devices.

1.1

The SD188ES/SD188EM demonstration board is designed with a 104-pin Am188 expansion interface that provides access to the Am188ES and Am188EM microcontrollers signals. The Am188 expansion interface facilitates prototyping with external devices by using the SD188ES/SD188EM demonstration board as the minimal system core of a design.

The SD188ES/SD188EM demonstration board highlights the Am188ES and Am188EM microcontrollers' serial ports, glueless interface to SRAM and Flash memory, and the expansion interface to peripheral attachments. A complete description of the board can be found in Chapter 2, "Demonstration Board Functional Description".

Theory of Operation

The SD188ES/SD188EM demonstration board demonstrates the basic processor functionality and features of the Am188ES and Am188EM microcontrollers, and the simplicity of their system design. As a stand-alone platform, the board enables you to test the Am188ES and Am188EM microcontrollers' performance and functionality. The minimal number of components on the board exhibits the integration present in the processor.

Demonstration Board Features

The SD188ES/SD188EM demonstration board provides the following features:

- Am188ES or Am188EM 40-MHz microcontroller
- E86™ family boot monitor (E86MON™) board-resident utility

  Information on invoking and using the E86MON software is provided in the *E86MON™ Software User's Manual* included in your kit.

- 128 Kbyte SRAM
- 128 Kbyte Am29F010-70 Flash memory
- Am188 104-pin expansion interface
- Two RS-232 serial ports with DB-9 connectors

  Please note that the Am188EM microcontroller provides one asynchronous serial port. Thus, when the board is populated with the Am188EM microcontroller, only one serial port is featured.

- Activity LED indicators for PIO signals
- Power-on LED indicator
- Reset circuitry

1.1

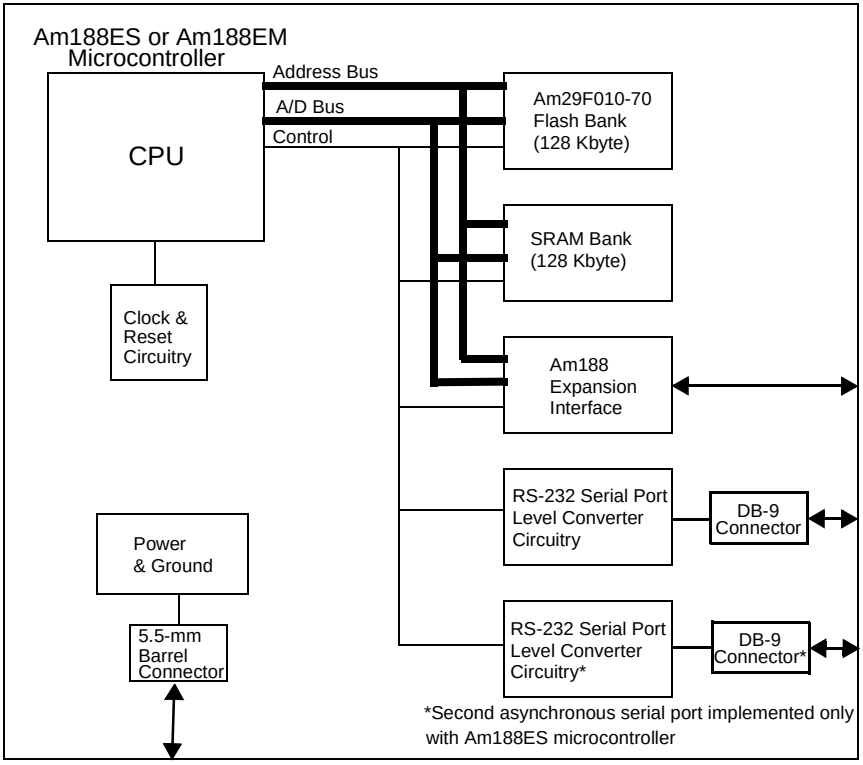


Figure 0-1. SD188ES/SD188EM Demonstration Board Block Diagram

1.1

SD188ES/SD188EM Demonstration Board Documentation

The *SD188ES/SD188EM Demonstration Board User's Manual* provides information on the design and function of the SD188ES/SD188EM demonstration board. Detailed instructions for using the E86MON software are provided in the *E86MON™ Software User's Manual* included in your kit. The demonstration board is shipped with the E86MON software installed in the on-board Flash memory.

About This Manual

Chapter 1, "Quick Start" provides implementation and installation information for the demonstration board and instructions for invoking the E86MON software. Detailed information on using the E86MON software is provided in the *E86MON™ Software User's Manual* included in your kit.

Chapter 2, "Demonstration Board Functional Description" contains descriptions of the basic sections of the demonstration board: layout, processor, Flash memory, SRAM, serial ports, power and signal LED indicators, clock and reset logic, expansion interface, and power-supply circuitry.

Chapter 3, "Product Support" provides information on reaching and using the AMD Corporate Applications technical support services, product information available through AMD's World Wide Web and FTP sites, and support tools for the embedded E86 family.

Appendix A, "Layout Diagram, Schematics, and Board Bill of Materials" contains a board layout drawing along with schematics and a Bill of Materials (BOM) for the SD188ES/SD188EM demonstration board.

1.1

Suggested Reference Material

For information on ordering the literature listed below, see Chapter 3, “Product Support”.

- *Am186™ES and Am188™ES Microcontrollers Data Sheet*
  Advanced Micro Devices, order number 20002
- *Am186™EM and Am188™EM Microcontrollers Data Sheet*
  Advanced Micro Devices, order number 19168
- *Am186™EM and Am188™EM Microcontrollers User’s Manual*
  Advanced Micro Devices, order number 19713
- *Am186™ES and Am188™ES Microcontrollers User’s Manual*
  Advanced Micro Devices, order number 21096
- *Am186™ and Am188™ Family Instruction Set Manual*
  Advanced Micro Devices, order number 21267
- *FusionE86℠ Catalog*
  Advanced Micro Devices, order number 19255
- For current application notes and technical bulletins, see our World Wide Web page at **http://www.amd.com**.

1.1

Documentation Conventions

The Advanced Micro Devices *SD188ES/SD188EM Demonstration Board User's Manual* uses the conventions shown in Table 0-1 (unless otherwise noted). These same conventions are used in all E86 family support product manuals.

Table 0-1. Notational Conventions

Symbol	Usage
Boldface	Indicates that characters must be entered exactly as shown, except that the alphabetic case is only significant when indicated.
`Typewriter face`	Indicates computer text input or output in an example or listing.

1.1

Chapter 1

Quick Start

This chapter provides information that will help you quickly set up and start using the SD188ES/SD188EM demonstration board.

The SD188ES/SD188EM demonstration board is supported by the E86MON software. The E86MON software enables you to load, run, and debug programs on the SD188ES/SD188EM demonstration board. For detailed information on using the E86MON software, refer to the *E86MON™ Software User's Manual* included in your kit.

For information on how to:

- Connect the SD188ES/SD188EM demonstration board to a PC, see page 1-2
- Invoke the E86MON software, see page 1-4
- Troubleshoot installation problems, see page 1-5
- Locate related sources of information, see page 1-6

1.1

Connecting to a PC

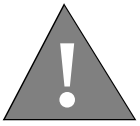
Follow the steps below to connect the SD188ES/SD188EM demonstration board to your PC.

Installation Requirements

The items listed below are necessary to install and run the SD188ES/SD188EM demonstration board:

- PC with an available COM port
- Terminal emulation software (such as Microsoft Windows® Terminal or ProComm Plus) that supports ASCII file transfers, software flow control (Xon/Xoff), and *send break* capability
- Power source for universal power supply

Board Installation

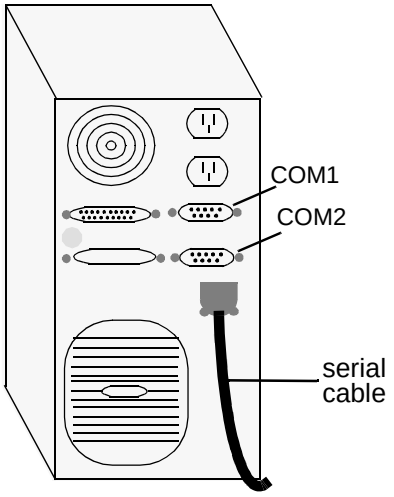


CAUTION: As with all computer equipment, the SD188ES/SD188EM demonstration board may be damaged by electrostatic discharge (ESD). Please take proper ESD precautions when handling any board.

1.1

1. Remove the board from the shipping carton. Visually inspect the board to verify that it was not damaged during shipment.

2. Connect the demonstration board's DB-9 serial port (either P1 or P0 on the ES version of the board; P1 on the EM version of the board) to an available COM port. Use the serial cable included in the SD188ES/SD188EM demonstration board kit and note that a DB-9 to DB-25 serial connector adapter is provided if your host system requires it. The pinout of the demonstration board's serial connector is shown on page 2-9.



1.1

DANGER: Make sure the power supply is *not* plugged into an electrical outlet before connecting it to the SD188ES/ SD188EM demonstration board

3. Connect the power supply to the barrel connector on the SD188ES/SD188EM demonstration board.
4. Apply power to the board by connecting the power supply to an electrical outlet. Once the board is powered up, the LEDs (CR3-CR10) should flash in an oscillating pattern.

CAUTION: If using your own power supply, ensure that it is a 5-V supply with the proper polarity (see page 2-14). Using a 9-V supply will permanently damage the board.

5. Invoke the terminal emulation program at 19200 baud, no parity, 8 data bits, and 1 stop bit; enable the software flow control (Xon/Xoff), if supported.

6. Reset the board by depressing and releasing the RESET switch (see location in Figure 2-1 on page 2-3). The LEDs on the board (CR3-CR10) will again flash in an oscillating pattern for three seconds, as they did upon power up.

   During the three-second period while the LEDs are oscillating, type an **a** in the terminal window to ensure that the E86MON software uses the correct baud rate. When the E86MON software receives an **a**, it adjusts its baud rate (if necessary) and displays the welcome message and prompt.

   If you type a character other than an **a**, or type no character at all, the E86MON software still displays the welcome message and prompt, but may be using an incorrect baud rate. Depressing and releasing the RESET switch gives you another opportunity to type an **a**.

7. To display the version of the E86MON software and the commands available, type **?** and press Enter.

   For detailed information on using the E86MON software, refer to the *E86MON™ Software User's Manual* included in your manual.

1.1

Table 1-1. Installation Troubleshooting

Problem	Solution
Nothing happens when pushing the RESET button.	Sometimes it is difficult to make a good connection when pushing the small RESET button. If all else fails, remove the power supply from the AC electrical outlet and disconnect and reconnect the power supply. The LEDs will flash in an oscillating pattern when the reset is successful.
The computer does not respond with the E86MON software prompt.	Reset the board by pressing the RESET switch and typing an **a** while the LEDs are flashing in an oscillating pattern. If this does not work, verify the power, check the cables, etc.
After typing **a** during reset, the terminal emulation software displays unreadable characters.	Check the baud rate setting for the terminal emulation software. It should be set to 19200. Also check the word length (8), stop bits (1), parity (N), and turn off any hardware flow control.
After a processor reset, the LEDs do not flash in the expected oscillating pattern.	Check that the power LED is on and the correct voltage is supplied to the board. Ensure that the polarity of the power connector is correct.
The terminal emulation program locks up the software or PC.	Check the COM port connection with the target board. Make sure that the same COM port is selected in the terminal emulation software. In some PCs if the correct COM port is not specified, the software will fail to function—it will lock in a continuous loop waiting for an answer from the incorrect serial port.
The power LED does not turn on with power.	Immediately disconnect the power supply. Ensure that the polarity of the power connector is correct. This is a very serious failure of the hardware. If the power source is connected incorrectly, the board will be permanently damaged.
There is a problem you cannot resolve.	Contact the AMD Corporate Applications technical support services. (See Chapter 3, "Product Support" for phone numbers and more information.)

For More Information...

If you need more information about:

- SD188ES/SD188EM demonstration board hardware,
  see Chapter 2,“Demonstration Board Functional Description”
- E86MON software,
  see the *E86MON™ Software User’s Manual*
- Problems with the board or the E86MON software,
  see Chapter 3,“Product Support”
- SD188ES/SD188EM demonstration board layout and schematics,
  see Appendix A,“Layout Diagram, Schematics, and Board Bill of Materials”
- the Am188ES microcontroller
  see the *Am186™ES and Am188™ES Microcontrollers Data Sheet*
- the Am188EM microcontroller,
  see the *Am186™EM and Am188™EM Microcontrollers Data Sheet*

1.1

Chapter 2

Demonstration Board Functional Description

The SD188ES/SD188EM demonstration board provides a completely stand-alone microcontroller-based evaluation platform in a low-cost, exceptionally small form-factor product. The SD188ES/SD188EM demonstration board was designed to meet the needs of customers working with the Am188ES and Am188EM microcontrollers.

Read the following sections to learn more about the SD188ES/SD188EM demonstration board hardware:

- "Layout and Placement" on page 2-2
- "Am188ES and Am188EM Microcontroller Implementation" on page 2-4
- "ROM Space" on page 2-7
- "SRAM" on page 2-7
- "RS-232 Serial Ports" on page 2-8
- "Clock and Reset Logic" on page 2-10
- "Am188 Expansion Interface" on page 2-10
- "PIO Activity LED Indicators" on page 2-13
- "Power Supply" on page 2-14

Layout and Placement

The design of the SD188ES/SD188EM demonstration board emphasizes ease of use and small size. Refer to Figure 2-1 on page 2-3 for board layout and component placement.

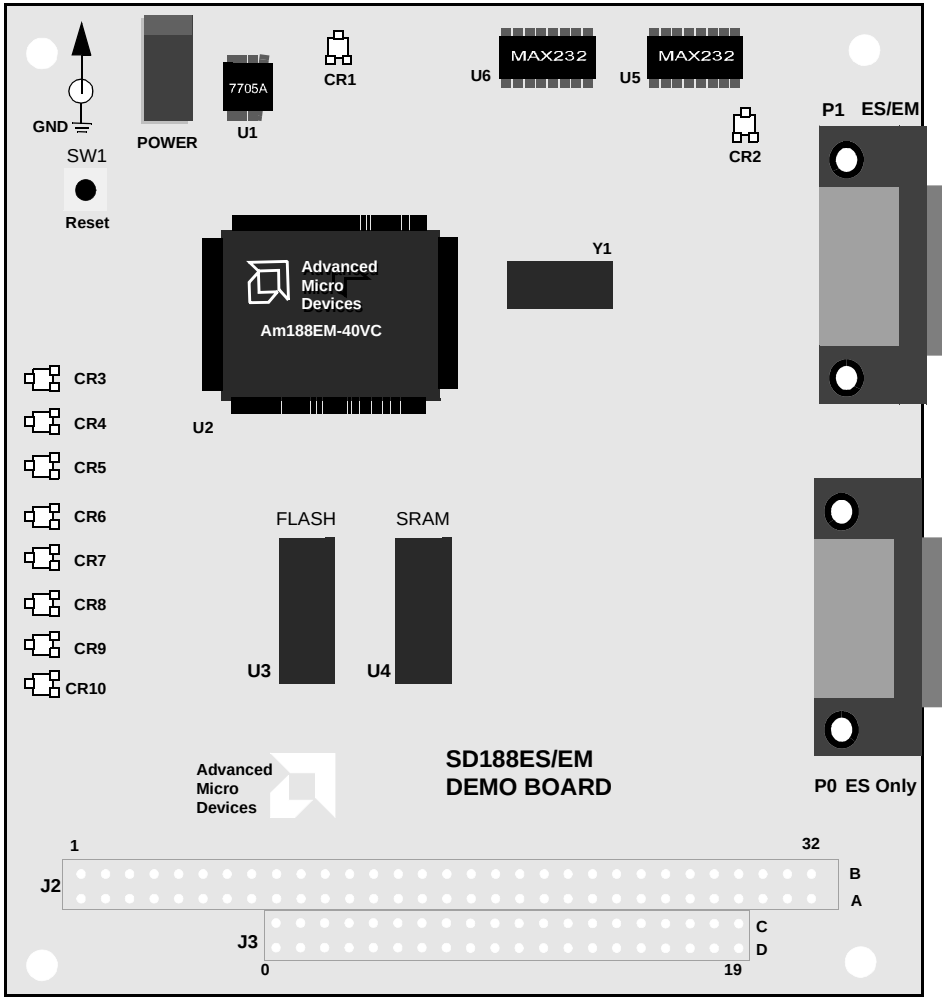
The SD188ES/SD188EM demonstration board has the Flash and SRAM memory devices (U4 and U3) directly below the processor. This placement keeps the memory devices as close as possible to the processor to minimize noise and trace reflections. The 40-MHz fundamental mode crystal (Y1) is located to the right of the processor. The expansion interface (J2 and J3) is located at the bottom of the board for easy connection and access. Finally, the 5.5-mm power-supply barrel connector (J1) is positioned in the upper, left corner of the board.

The RS-232 serial interfaces are positioned on the right of the board. Please note that the ES version of the board features two serial ports (P0 and P1), which are driven by the two asynchronous serial interfaces on the Am188ES microcontroller. The Am188EM microcontroller provides one asynchronous serial interface so the EM version of the board implements the serial port with a DB-9 connector (P1).

1.1

Table 2-1. SD188ES/SD188EM Demonstration Board Parts List

Part Number	Description	For more information, see
CR1–CR10	Power and signal LEDs	Page 2-13
J1	Power connector	Page 2-14
J2-J3	Expansion interface	Page 2-10
U1	Voltage supply supervisor (TI TL7705A)	Page 2-10
U2	Am188ES or Am188EM 40-MHz microcontroller	Page 2-4
U3	Flash memory	Page 2-7
U4	SRAM	Page 2-7
U5–U6	RS-232 driver/receiver devices (MAX232)	Page 2-8
Y1	40-MHz fundamental mode crystal	Page 2-10



Notes:

1.On the SD186ES demonstration board, P1 is asynchronous serial port 0; P0 is asynchronous serial port 1.

2.On the SD186EM demonstration board, P1 is an asynchronous serial port; P0 does not exist.

Figure 2-1. SD188ES/SD188EM Demonstration Board Layout

Am188ES and Am188EM Microcontrollers Implementation

The SD188ES/SD188EM demonstration board supports the AMD Am188ES and Am188EM microcontrollers. The board is shipped with either an Am188ES or Am188EM microcontroller that operates at 40 MHz. Although not supported by the on-board crystal, the Am188ES and Am188EM microcontrollers are also available in 20-, 25-, and 33-MHz operating frequencies.

The Am188ES and Am188EM microcontrollers are designed to meet the most common requirements of embedded products developed for the communications, office automation, mass storage, and general embedded markets. Specific applications include feature phones, cellular phones, PBXs, multiplexers, modems, disk drive controllers, hand-held and desktop terminals, fax machines, line cards, managed hubs, and industrial control. Refer to the *Am186™ES and Am188™ES Microcontrollers Data Sheet* and the *Am186™EM and Am188™EM Microcontrollers Data Sheet* for more information on the specific features of the Am188ES and Am188EM microcontrollers.

1.1

See Figure 2-2 on page 2-5 for a block diagram detailing the Am188ES microcontroller's functionality. See Figure 2-3 on page 2-6 for a block diagram detailing the Am188EM microcontroller's functionality.

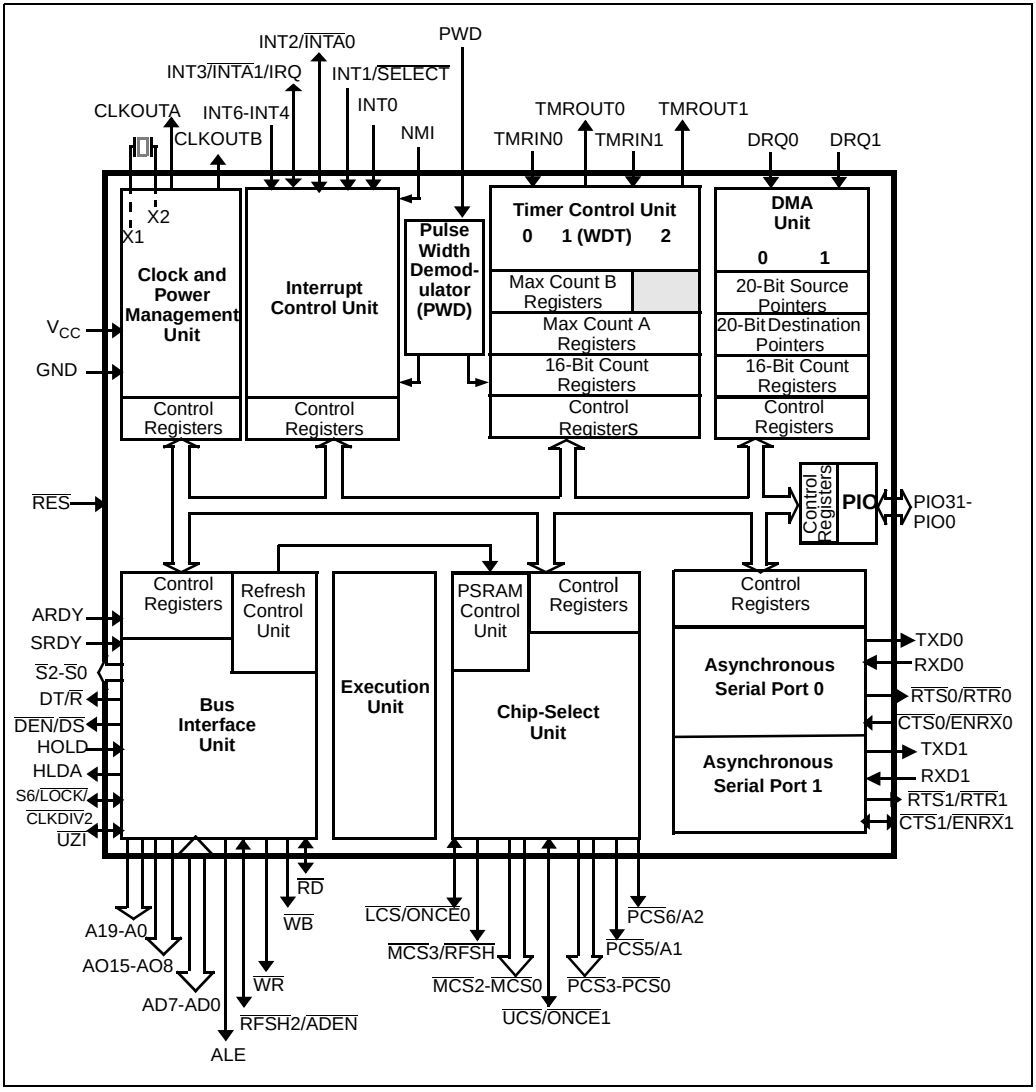


Figure 2-2. Am188ES Microcontroller Block Diagram

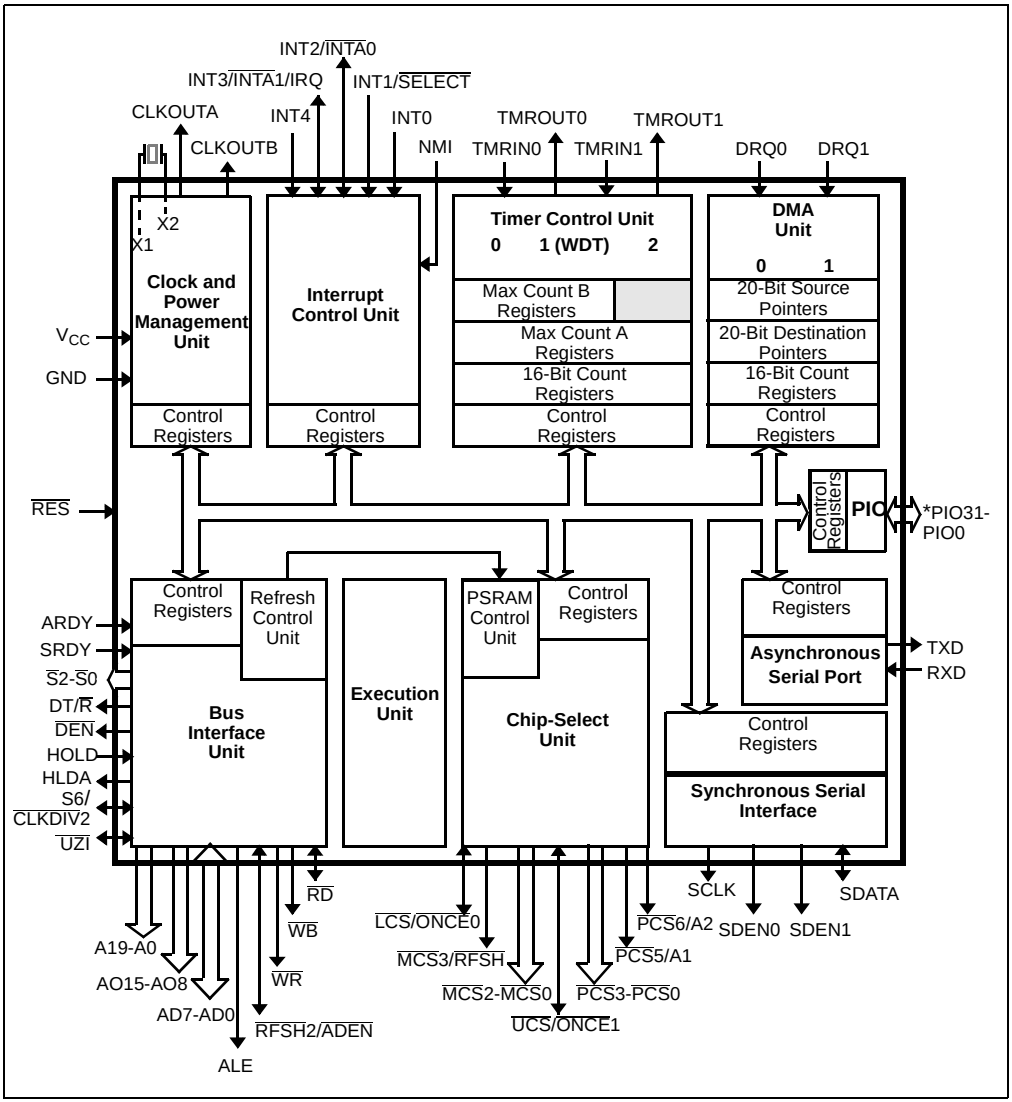


Figure 2-3. Am188EM Microcontroller Block Diagram

ROM Space

The SD188ES/SD188EM demonstration board contains on-board ROM space for use by the E86MON software and application code. This ROM space is implemented as one Am29F010 70-ns Flash memory device.

This Flash memory device is mapped to the upper region of addressable memory at E0000h to FFFFFh. The Flash memory device is organized as 128K x 8 bits (eight, 16K sectors) and is connected to the $\overline{\text{UCS}}$ (Upper Memory Chip Select) signal of the microcontroller. After a valid reset, the Am188ES or Am188EM microcontroller fetches the first instruction from the Flash memory device by asserting $\overline{\text{UCS}}$ and driving the address bus with the value FFFF0h.

The E86MON software enables you to program the Flash memory device with specific types of hex files. Intel hex and Intel extended hex format files are supported. This software functionality is provided to eliminate the need to remove the Flash memory device. Do not attempt to remove the TSOP Flash or SRAM (U3, U4, U7, and U8) memory devices because doing so may cause damage to the board.

1.1

SRAM

The SD188ES/SD188EM demonstration board utilizes SRAM for its read/write storage. The board provides 128 Kbyte of SRAM using one 70-ns device that is mapped from 0h to 1FFFFh. The SRAM device is organized as 128K x 8 bits and is attached to the $\overline{\text{LCS}}$ (Lower Memory Chip Select) signal of the microcontroller. For every access to the above address range, the Am188ES and Am188EM microcontrollers will assert $\overline{\text{LCS}}$.

NOTE: SRAM available to you includes 410h to 1F400h. See the *E86MON*™ *Software User's Manual* included in your kit for more information.

RS-232 Serial Ports

The ES version of the SD188ES/SD188EM demonstration board provides two on-board RS-232 serial ports (P0, P1) that are directly driven by the Am188ES microcontroller. The serial ports are equipped with DB-9 DCE connectors. The pin assignment for the DB-9 connectors is shown in Figure 2-4 on page 2-9.

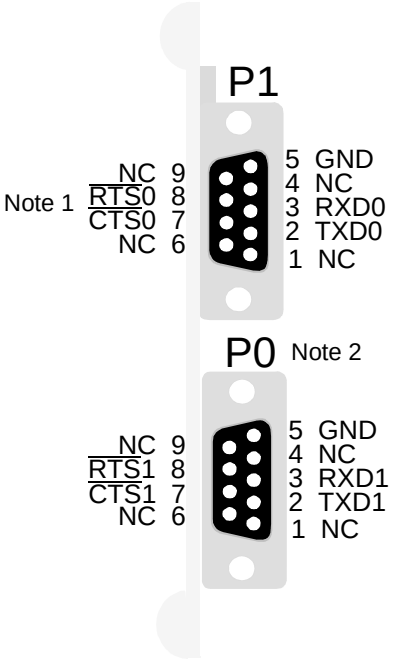
The EM version of the SD188ES/SD188EM demonstration board provides one on-board RS-232 serial port that is directly driven by the Am188EM microcontroller. The RS-232 serial port (P1) is equipped with a DB-9 DCE connector. The pin assignment for the DB-9 connector is shown in Figure 2-4 on page 2-9.

The Am188EM serial port does not provide RTS and CTS support in hardware. The $\overline{\text{PSC}}$3 and $\overline{\text{PSC}}$2 pins are wired to the corresponding signals and can be configured as PIO outputs for limited RTS and CTS support via software.

Traditionally, PCs have Data Terminal Equipment (DTE) ports which connect directly to the Data Communication Equipment (DCE) port on the SD188ES/SD188EM demonstration board. A null modem cable is not required to connect a DTE port with a DCE port.

1.1

The RS-232 specification calls for signals that are driven at non-TTL levels. Single-chip RS-232 driver/receiver devices (MAX232, U5 and U6) are used to convert to and from the required voltages.



Notes:

1. *The SD188EM serial port does not support $\overline{RTS0}$ and $\overline{CTS0}$ in hardware. Instead, these signals are connected to $\overline{PCS3}$ and $\overline{PCS2}$.*
2. *The SD188EM demonstration board has only one asynchronous serial port. The serial port is connected to P1.*

Figure 2-4. DB-9 Serial Connector Pinout

1.1

Clock and Reset Logic

The Am188ES and Am188EM microcontrollers can be configured for either 1x or ½x clock mode. As configured on the SD188ES/SD188EM demonstration board, the microcontroller is in 1x clock mode. The input is generated by a 40-MHz fundamental mode crystal (Y1) that is connected to the X1/X2 inputs of the microcontrollers, resulting in a 40-MHz system clock.

System reset is controlled by a voltage supply supervisor (TI TL7705A, U1). This device generates the processor's reset input, asserting the Am188ES or Am188EM microcontroller's $\overline{\text{RES}}$ pin for 13 ms when the RESET switch is depressed. The voltage supply supervisor also holds reset active when the power falls below 4.75 V.

Am188 Expansion Interface

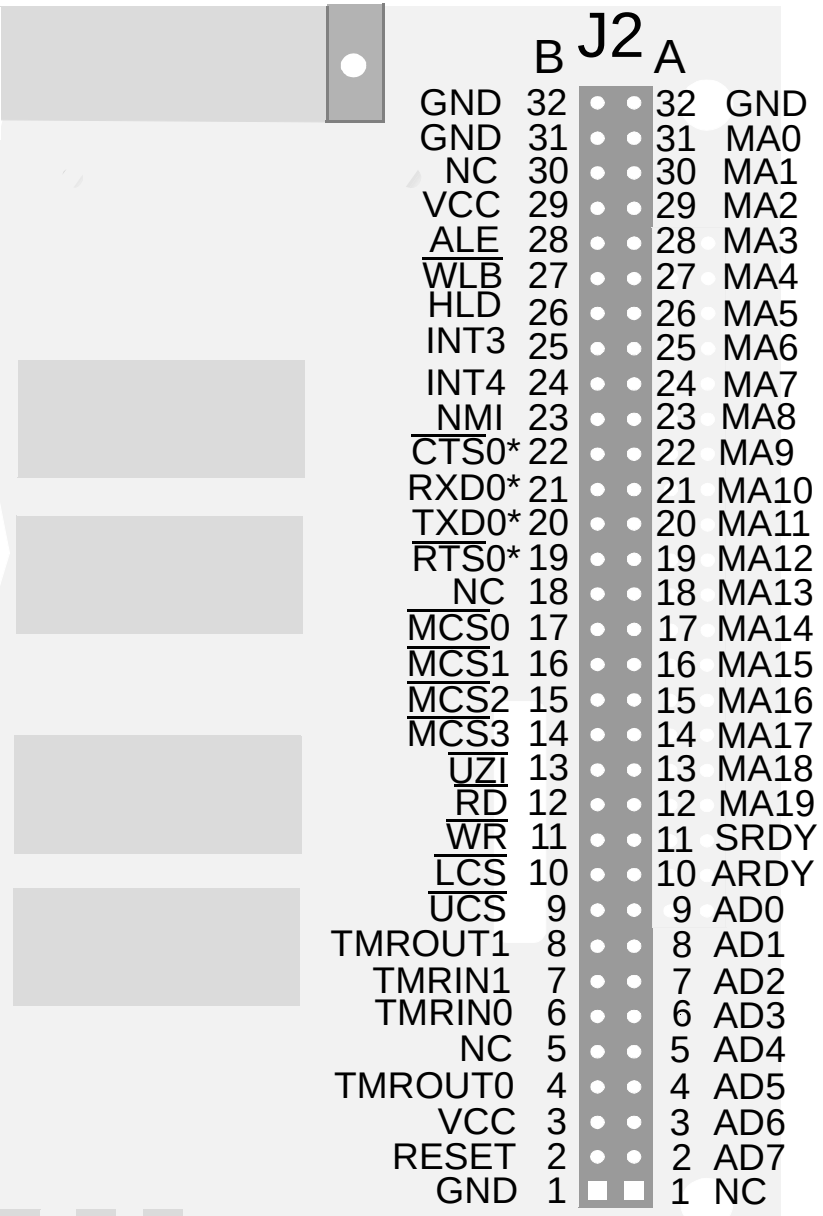
The SD188ES/SD188EM demonstration board supports the PC/104 form-factor expansion-type connector for additional prototyping and testing. The traditional PC/104 signals are not present on the board; however, the Am188 expansion interface enables you to attach wirewrap or prototype boards that have the same standard physical interface. The pinout of the expansion interface for the SD188ES is shown in the figures that follow.

1.1

NOTE: The pinout of the expansion interface is identical for both the SD188ES and SD188EM demonstration boards except for the four pins shown in Table 2-2.

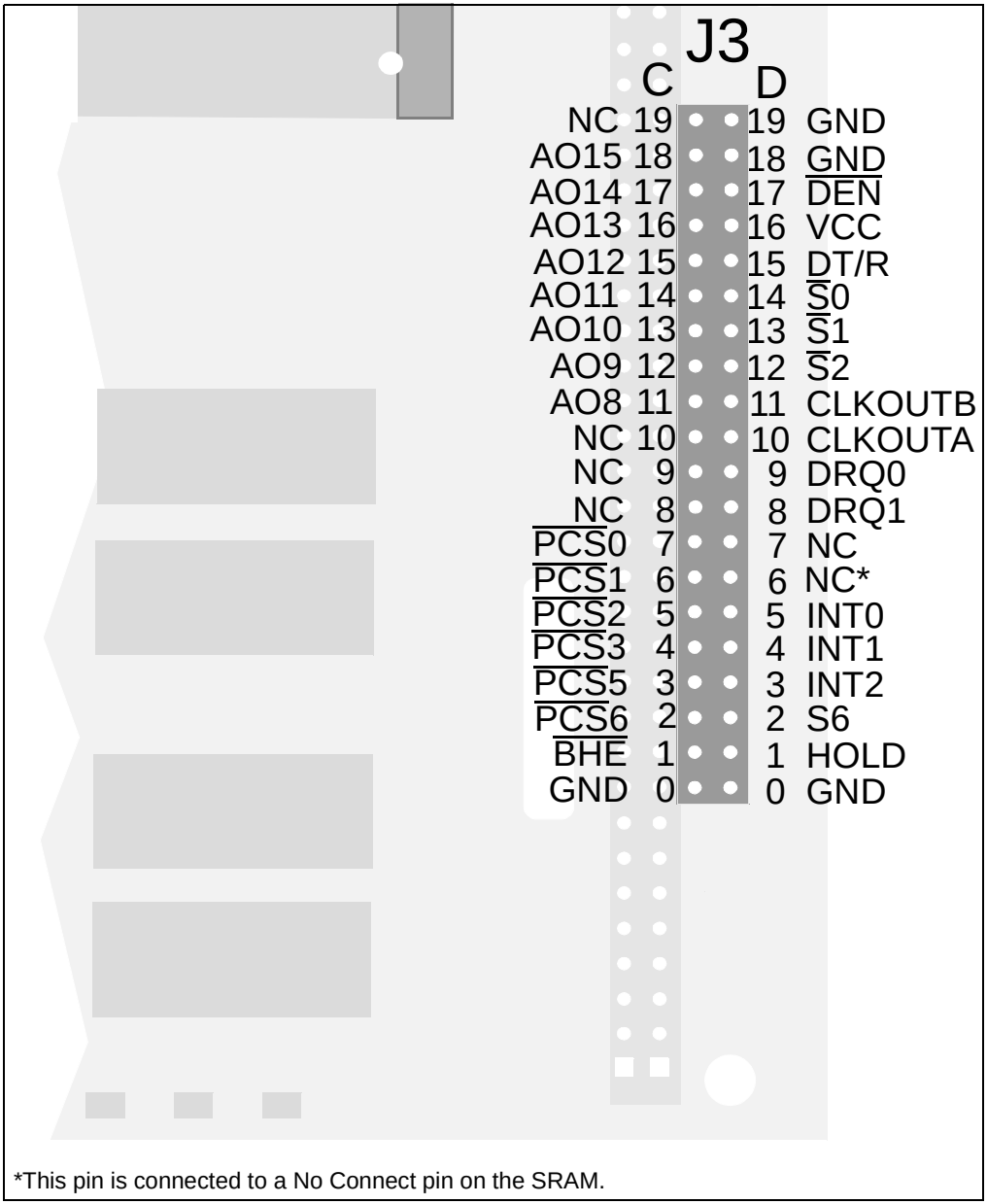
Table 2-2. Expansion Interface SD188ES/SD188EM Pinout Differences

J2 Pin Number	SD188ES Pin Name	SD188EM Pin Name
B19	$\overline{\text{RTS}}$0	SCLK
B20	TXD0	SDEN0
B21	RXD0	SDEN1
B22	$\overline{\text{CTS}}$0	SDATA



*Refer to Table 2-2 for a description of these pins.

Figure 2-5. Am188 Expansion Interface Pinout (J2)



*This pin is connected to a No Connect pin on the SRAM.

1.1

Figure 2-6. Am188 Expansion Interface Pinout (J3)

PIO Activity LED Indicators

The SD188ES/SD188EM demonstration board uses on-board LED indicators to show activity on the upper eight programmable I/O (PIO) signals from the Am188ES or Am188EM microcontroller. Table 2-3 shows which PIO signal is represented by each LED.

Table 2-3. PIO LED Indicator Interface

LED	PIO Pin Name	PIO Register Bit Number
CR3	$\overline{\text{MCS}}$1	15
CR4	$\overline{\text{MCS}}$0	14
CR5	$\overline{\text{DEN}}$	5
CR6	DT/$\overline{\text{R}}$	4
CR7	$\overline{\text{PCS}}$5	3
CR8	$\overline{\text{PCS}}$6	2
CR9	TMROUT1	1
CR10	TMRIN1	0

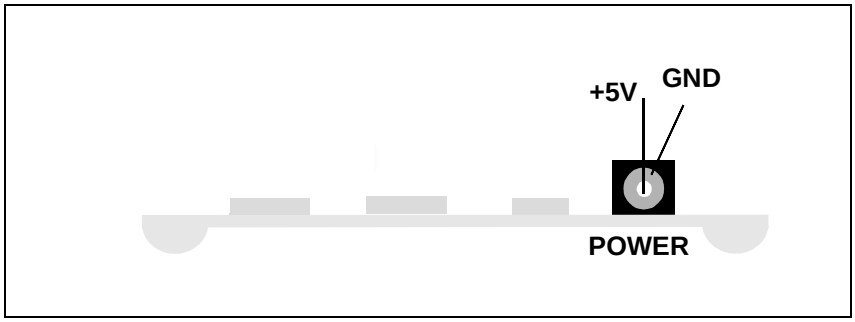
1.1

Power Supply

When used as a stand-alone board, the SD188ES/SD188EM demonstration board requires an input power supply of 5.0 V DC, ±5%, 250 mA.

When adding components to the SD188ES/SD188EM demonstration board via the expansion interface, additional power may be necessary.

The power supply connector is a 5.5-mm barrel connector where the center post is V_{CC} and the outer ring is GND, as shown in Figure 2-7.



1.1

Figure 2-7. Power Supply Polarity

CAUTION: Use the 5-V universal power supply included with the kit. Using a 9-V supply will permanently damage the board.

Chapter 3

Product Support

This chapter contains information on:

- Reaching and using the AMD Corporate Applications technical support services, on page 3-2
- Product information available through AMD's World Wide Web and FTP sites, on page 3-4
- Support tools for the E86 family, on page 3-5

AMD Corporate Applications Technical Support Services

Technical support for the E86 family of microcontrollers and corresponding support products is available via e-mail, online (BBS and WWW), or through telephone or fax.

E-Mail Support

Please include your name, company, telephone number, AMD product requiring support, and question or problem in all e-mail correspondence.

In the USA and Canada, send mail to:

`HW.Support@amd.com`

In Europe and the UK, send mail to:

`euro.tech@amd.com`

1.1

Online Support

AMD offers technical support on our WWW site, and through our bulletin board services. See “Product Support” on page 3-4 for more on what our WWW and FTP sites have to offer.

WWW Technical Support

Go to AMD’s home page at **http://www.amd.com** and click on “Service” for the latest AMD technical support phone numbers, software, and Frequently Asked Questions.

Bulletin Board Support

Country	**Number**
USA and Canada	(408) 749-4659
UK and Europe	44-(0) 1276-803-211

Telephone and Fax Support

Telephone assistance is available in the U.S. from 8:00 A.M. to 5:00 P.M. Pacific time, Monday through Friday (except major holidays). In Europe, assistance is available during U.K. business hours. Contact the hotlines at one of the following telephone or fax numbers.

Direct Dial Numbers

Country	Number
USA and Canada	Tel.: (408) 749-5703 Fax: (408) 749-4753
Japan	Tel.: (03) 3346-7550 Fax: (03) 3346-9828
Far East Asia	Fax: (852) 2956-0599
Germany	Tel.: 089 450 53199
UK and Europe	Tel.: 44-(0) 1276-803-299 Fax: 44-(0) 1276-803-298

Toll-Free Numbers

Country	Number
USA and Canada	(800) 222-9323
France	0590-8621
Italy	1678-77224
Japan	0031-11-1163

Product Support

AMD's WWW and FTP sites are described below. Questions, requests, and input concerning these sites can be sent via e-mail to **webmaster@amd.com**.

WWW Site

A subset of the AMD WWW pages, the embedded processor pages are frequently updated and include general product information, technical documentation, and support and tool information. To access these pages, go to the AMD home page at **http://www.amd.com** and click on "Embedded Processors" or access the pages directly at **http://www.amd-embedded.com**.

The "Embedded Processors" home page is divided into four sections:

- "What's New" announces new E86 family products, and highlights new applications using our products.
- "Product Overviews" briefly describes all the microprocessors and microcontrollers in the E86 family, and describes how these parts are ideal in specific focus markets.
- "Support and Tools" provides information about the tools that support our processors, and offers online benchmarking tools.
- "Technical Documentation" provides the *Available Literature List* of datasheets, application notes, user's manuals, and promotional literature, and describes how to order these documents. Many are also available online in PDF form. (To access the Literature Ordering Center via telephone, call one of the numbers listed on the back cover of your manual).
- "Demo Board Updates" provides a link to the AMD FTP site where the latest E86MON software releases are availalbe.

1.1

FTP Site

In addition to the documentation on our WWW pages, AMD provides software through an anonymous FTP site. To download the software, ftp to **ftp.amd.com** and log on as "anonymous" using your e-mail address as a password. Or via your web browser, go to **ftp://ftp.amd.com**. Software relating to the E86 family can be found in the **/pub/epd/e86/** directory.

Third-Party Development Support Products

The FusionE86^{SM} Program of Partnerships for Application Solutions provides the customer with an array of products designed to meet critical time-to-market needs. Products and solutions available from the AMD FusionE86 partners include emulators, hardware and software debuggers, board-level products, and software development tools, among others. The *FusionE86*^{SM} *Catalog*, order# 19255, describes these solutions.

In addition, mature development tools and applications for the x86 platform are widely available in the general marketplace.

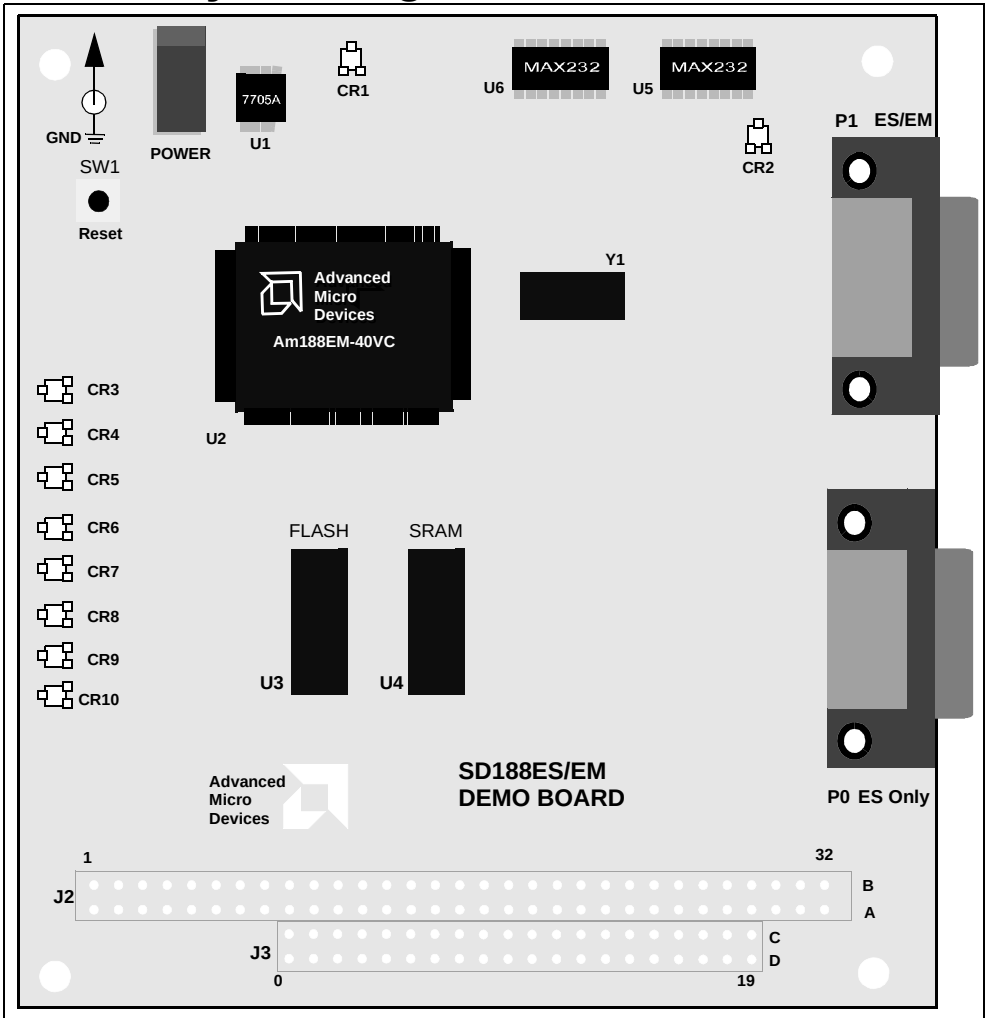
1.1

Appendix A

Layout Diagram, Schematics, and Board Bill of Materials

This appendix contains a board layout diagram, schematics, and the bill of materials (BOM) for the SD188ES/SD188EM demonstration board.

Board Layout Diagram



Notes:

1.On the SD186ES demonstration board, P1 is asynchronous serial port 0; P0 is asynchronous serial port 1.

2.On the SD186EM demonstration board, P1 is an asynchronous serial port; P0 does not exist.

Figure A-1. SD188ES/SD188EM Demonstration Board Layout

1.1

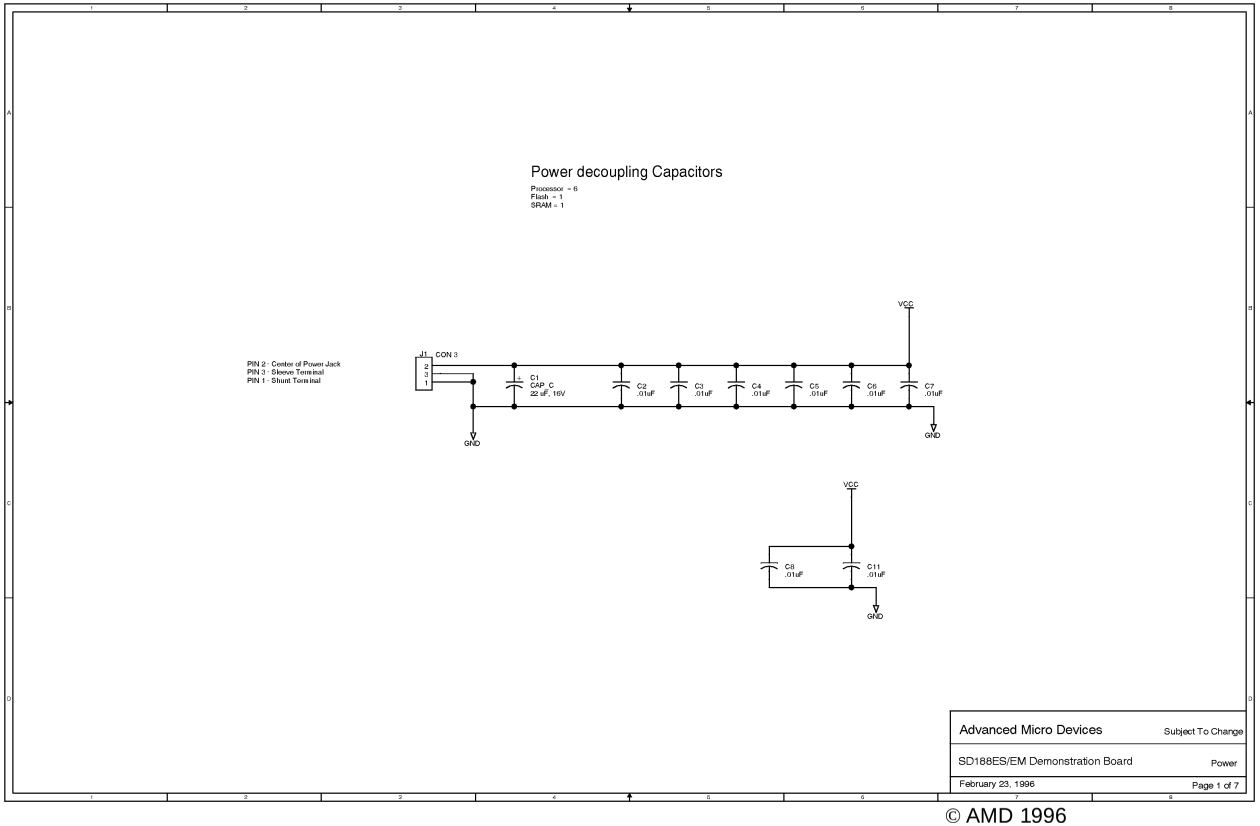
Schematics

The SD188ES/SD188EM demonstration board schematics have been blocked out to separate functionality of the design onto separate pages as follows:

- Page A-4 contains the power connector and decoupling capacitors
- Page A-5 contains the Am188ES or Am188EM microcontroller, clock, and reset circuitry
- Page A-6 contains the Flash device
- Page A-7 contains the serial ports and corresponding LEDs
- Page A-8 contains the SRAM device
- Page A-9 contains the PIO LEDs
- Page A-10 contains the Am188 interface and signal termination

NOTE: These schematics and design are subject to change.

1.1


Power decoupling Capacitors
Processor = 6
Flash = 1
SRAM = 1
PIN 2 - Center of Power Jack
PIN 3 - Sleeve Terminal
PIN 1 - Shunt Terminal
J1
CON 3
C1
CAP_C
22 uF, 16V
C2
.01uF
C3
.01uF
C4
.01uF
C5
.01uF
C6
.01uF
C7
.01uF
C8
.01uF
C11
.01uF
VCC
GND
Advanced Micro Devices
Subject To Change
SD188ES/EM Demonstration Board
Power
February 23, 1996
Page 1 of 7

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Am188ES/EM Processor
and Reset Logic
Advanced Micro Devices
Subject To Change
SD188ES/EM Demonstration Board
Am188ES/Reset Logic
February 23, 1996
Page 2 of 7
U2
188ES PQFP
U1
SDRXE
RESIN
RST
REF
TL7705A
U3
SPST_SW/@SPST_SWITCH_SURF
SW1
Y1
MA-306
RESET
RES
NMI
VCC
GND
A[0..19]
AD[0..15]
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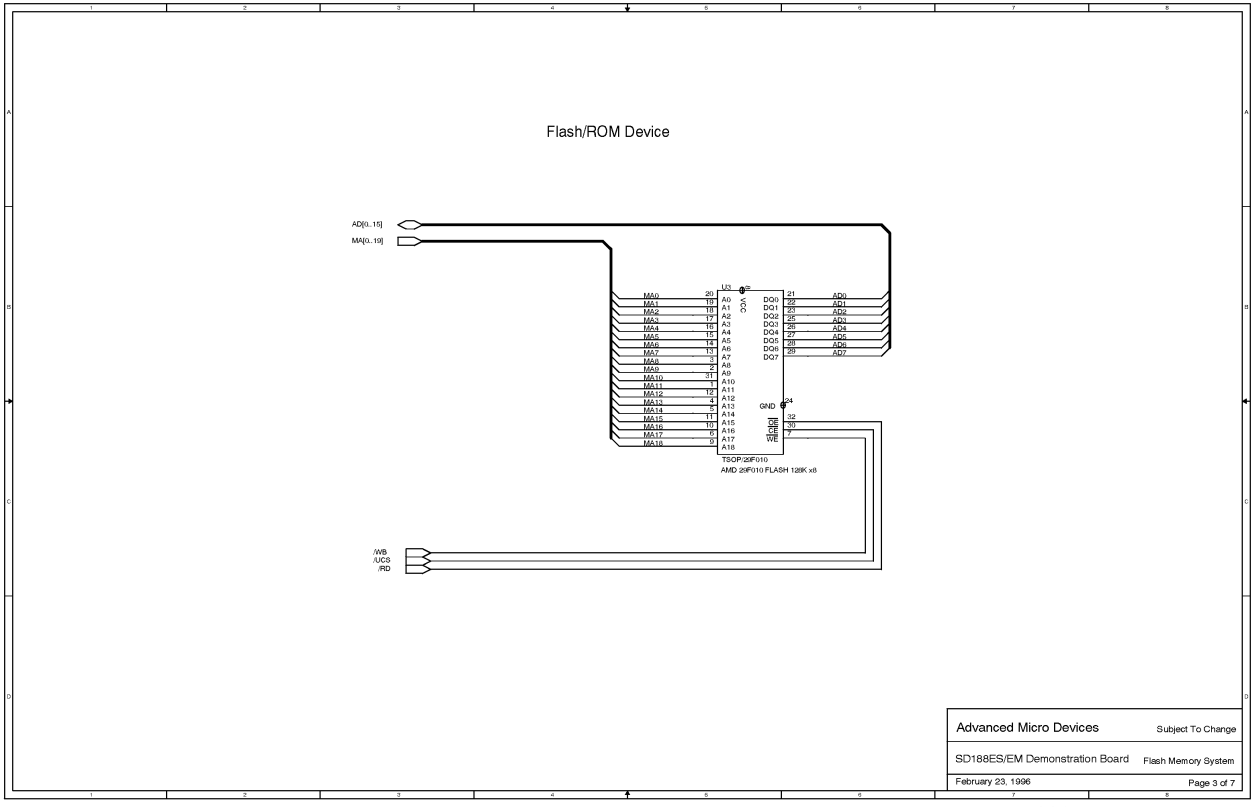
Flash/ROM Device
AD[0..15]
MA[0..19]
U3
MA0 26
MA1 19
MA2 18
MA3 17
MA4 16
MA5 15
MA6 14
MA7 13
MA8 3
MA9 2
MA10 31
MA11 1
MA12 12
MA13 4
MA14 5
MA15 11
MA16 10
MA17 6
MA18 9
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18
VCC 22
DQ0 21 AD0
DQ1 22 AD1
DQ2 23 AD2
DQ3 25 AD3
DQ4 26 AD4
DQ5 27 AD5
DQ6 28 AD6
DQ7 29 AD7
GND 24
/OE 32
/CE 30
/WE 7
TSOP/28F010
AMD 28F010 FLASH 128K x8
/WB
/UCS
/RD
Advanced Micro Devices
Subject To Change
SD188ES/EM Demonstration Board
Flash Memory System
February 23, 1996
Page 3 of 7

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Serial Port/LEDs
Serial Port 0
ES Only
Serial Port 1
ES/EM
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SD188ES/EM Demonstration Board
Serial I/O
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Page 4 of 7
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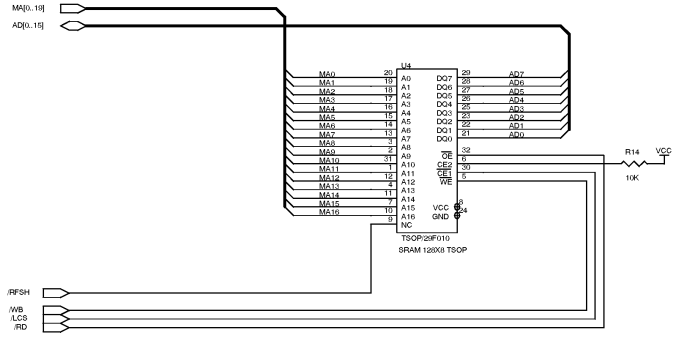
SRAM 128K x 8 Device



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SD188ES/EM Demonstration Board	SRAM Memory System
February 23, 1996	Page 5 of 7

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PIO LEDs
Advanced Micro Devices
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SD188ES/EM Demonstration Board
PIO LEDs
February 23, 1996
Page 6 of 7
VCC
R15
0
R16
R17
R18
R19
R20
R21
R22
R23
220
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
RED
GREEN
CATH
SOT23REV@SOT23
MCS1
MCS0
DEN
DT/R
PCS5
PCS6
TMROUT1
TMRIN1

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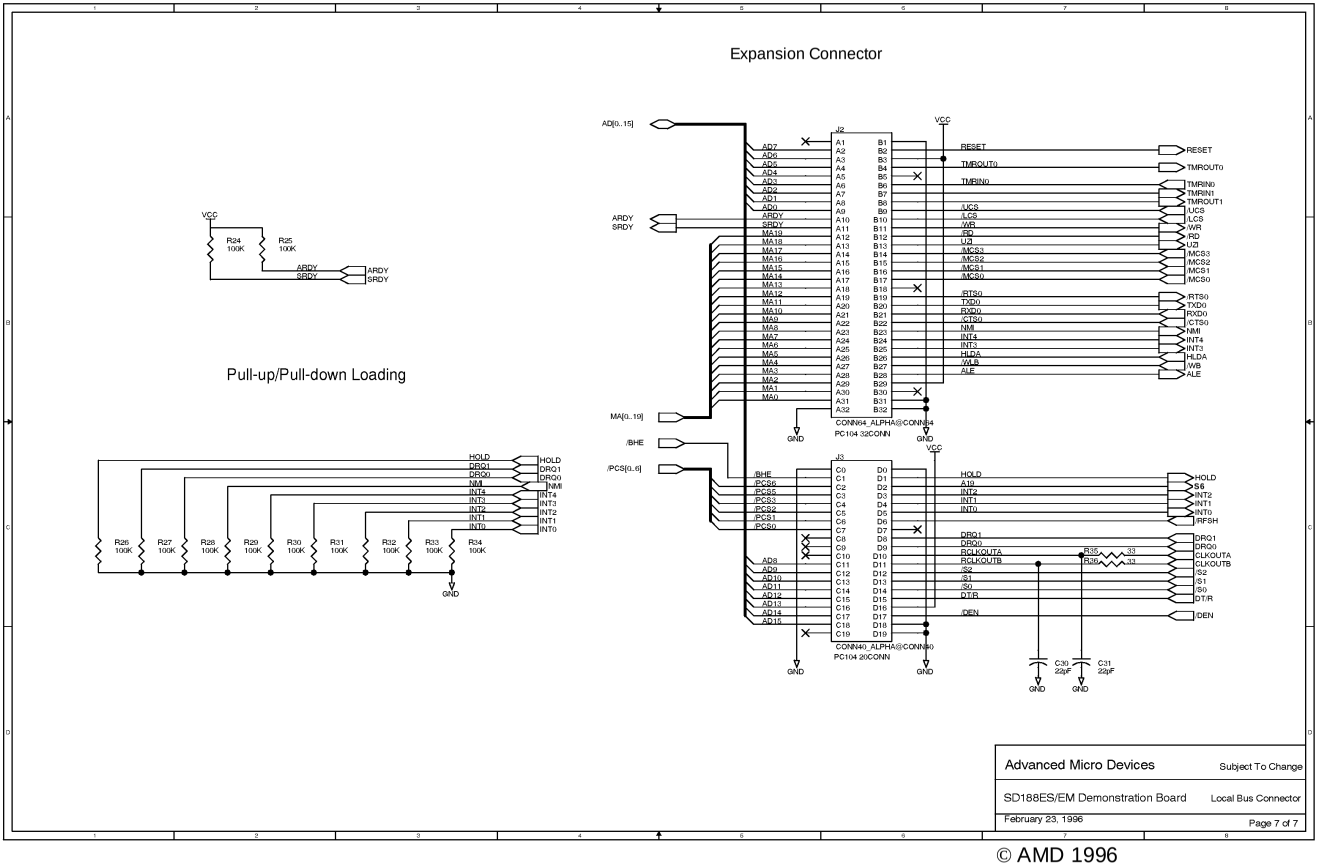
Expansion Connector
Pull-up/Pull-down Loading
VCC
R24 100K
R25 100K
ARDY
SRDY
R26 100K
R27 100K
R28 100K
R29 100K
R30 100K
R31 100K
R32 100K
R33 100K
R34 100K
HOLD
DRQ1
DRQ0
NMI
INT4
INT3
INT2
INT1
INT0
GND
AD[0..15]
MA[0..19]
/BHE
/PCS[0..6]
J2
J3
CONN64_ALPHA@CONN64
PC104 32CONN
CONN40_ALPHA@CONN40
PC104 20CONN
RESET
TMROUT0
TMRIN0
TMRIN1
TMROUT1
/UCS
/LCS
/WR
/RD
U2I
/MCS3
/MCS2
/MCS1
/MCS0
/RTS0
TXD0
RXD0
/CTS0
HLDA
/WLB
ALE
A19
/S6
/RFSH
RCLKOUTA
RCLKOUTB
/S2
/S1
/S0
DT/R
/DEN
R35 33
R36 33
C30 22pF
C31 22pF
Advanced Micro Devices
Subject To Change
SD188ES/EM Demonstration Board
Local Bus Connector
February 23, 1996
Page 7 of 7

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Board Bill of Materials (BOM)

Table A-1. SD188ES/SD188EM Demonstration Board BOM

Qty	Ref	Description	MFG1	Part No 1
1	C1	22 MFd, SMT, C case, 20 V	Any	
1	C12	1.0 MFd, SMT, 16 V	Any	
9	C13, C16, C17, C24-C29	0.1 MFd, SMT, 20 V	Any	
1	C14	15 PFd, SMT, 16 V	Any	
9	C15, C18-23, C30, C31	22 PFd, SMT, 16 V	Any	
8	C2-C8, C11	0.01 MFd, SMT, 16 V	Any	
10	CR1-CR10	LED, 3 Pin, SMT	Rohm	SLM-23VMW
1	J1	Power Jack, 5.5 mm, RA	Switchcraft	RAPC-712
0	J2	AM186 Conn, 64-Pin Header	Not Populated	
0	J3	AM186 Conn 40-Pin Header	Not Populated	
2	P0*, P1	DB9 right angle connector, Front Metal-Shell	AMP	787844-1
12	R1, R24-R34	100K Ohms, 5%	Any	
2	R10, R12	390 Ohms, 5%	Any	
8	R16-R23	220 Ohms, 5%	Any	
3	R2, R14, R37	10K Ohms, 5%	Any	
7	R3-R8, R15	0K Ohms	Any	
4	R9, R11, R35, R36	33 Ohms, 5%	Any	
1	SW1	Reset Switch, (SMT-J lead)	C & K	KT11P3JM
1	U1	Reset Controller, SMT	TI	TL7705ACD
1	U2	Am188ES Microcontroller or Am188EM Microcontroller	AMD	
1	U3	128K x 8 Flash EPROM (SMT)	AMD	Am29F010-70EC
1	U4	128K x 8 SRAM (SMT)	Hitachi	HM628128T-7
1	U5*, U6	RS-232 Driver, narrow SMT	Maxim	MAX232ACSE
1	Y1	40.0 MHz High Frequency Quartz Crystal, 16 pF	Epson	MA-306

* Not present on the SD188EM Demonstration Board.

1.1

Index

A

Am188 expansion interface,
    See expansion interface
Am188EM microcontroller
    block diagram, 2-6
    operating frequency, 2-4
Am188ES microcontroller
    block diagram, 2-5
    operating frequency, 2-4
AM29F010 Flash, 2-7

B

baud rate setting, 1-4
BBS technical support, 3-2
bill of materials, A-11

C

clock configuration, 2-10
clock logic, 2-10
clock rates supported, 2-10
COM ports,
    See ports
connecting
    demo board to PC, 1-2
connectors
    DB-9, 1-3
conventions
    documentation, xii
CR1–CR10 LEDs
    location on board, 2-2
CR3–CR10 LEDs
    on power-up, 1-4
CR3–CR10 PIO LEDs, 2-13

D

data bits setting, 1-4
DB–9 serial connector pinout, 2-9
$\overline{\text{DEN}}$ pin, 2-13
documentation
    conventions, xii
    description of, x, xi, xii
    manual contents, x
    reference material, xi
DT/$\overline{\text{R}}$ pin, 2-13

E

E86MON utility
    invoking, 1-4
e-mail technical support, 3-2
expansion interface, 2-10
    J2 pinout, 2-11
    J3 pinout, 2-12

F

features
SD188ES/SD188EM
demonstration board, viii
Flash memory overview, 2-7
FTP site, 3-5
FusionE86 program, 3-5

H

hotline numbers, 3-3

I

installation
requirements, 1-2
troubleshooting, 1-5
interfaces
expansion, 2-10
RS-232 serial, 2-8

J

J1, J2, and J3 locations on board, 2-2

L

LED
LEDs
CR3–CR10, 1-4
flashing incorrectly, 1-5
indicators, 2-13
no power, 1-5
PIO indicators, 2-13

M

memory
Flash, 2-7
ROM, 2-7
SRAM, 2-7

P

parity setting, 1-4
PC
connecting demo board to, 1-2
PC/104 expansion interface
See expansion interface
$\overline{\text{PCS}}$ pins, 2-13
pinout
AM188 interface (J2), 2-11
AM188 interface (J3), 2-12
DB–9 serial connector, 2-9
RS-232 serial port, 2-8–2-9
PIO signals
mapped to LEDs, 2-13
overview, 2-13
ports
COM1, 1-3
COM2, 1-3
expansion, 2-10
RS-232 serial, 2-8
serial, 1-3
power supply
5-V vs. 9-V, 1-3
input requirements, 2-14
polarity, 2-14
to the board, 1-3
product support
FTP site, 3-5
third party (FusionE86), 3-5
WWW site, 3-4

1.1

R

RES pin, 2-10
RESET button
    nothing happens when pushing, 1-5
    resetting board with, 1-4
reset logic, 2-10
ROM space, 2-7
RS-232 serial port
    See ports

S

schematics, A-3
SD188ES/SD188EM demonstration board
    bill of materials, A-11
    block diagram, ix
    clock logic, 2-10
    connecting DB-9 connector to PC, 1-3
    design, 2-2
    documentation, x
    expansion interface, 2-10
    features, viii
    installing, 1-3
    layout and placement, 2-2
    layout illustration, 2-3, A-2
    LEDs, 2-13
    overview, vii
    parts list, 2-2
    PIOs, 2-13
    power supply, 2-14
    reset logic, 2-10
    ROM space, 2-7
    RS-232 serial port, 2-8
    schematics, A-3
    SRAM, 2-7
    technical support, 3-1
serial ports, 1-3
SRAM, 2-7
stop bits setting, 1-4
support, product. *See* product support.
support, technical.
    See technical support

T

technical support, 3-1
    BBS support, 3-2
    e-mail support, 3-2
    hotline numbers, 3-3
    WWW support, 3-2
terminal emulation program
    displaying unreadable characters, 1-5
    locking up, 1-5
TMRIN1 pin, 2-13
TMROUT1 pin, 2-13
troubleshooting
    installation, 1-5

U

U1–U6 location on board, 2-2
USC (Upper Memory Chip Select) signal, 2-7

W

WWW
    product support, 3-4
    technical support, 3-2

Y

Y1 location on board, 2-2

1.1